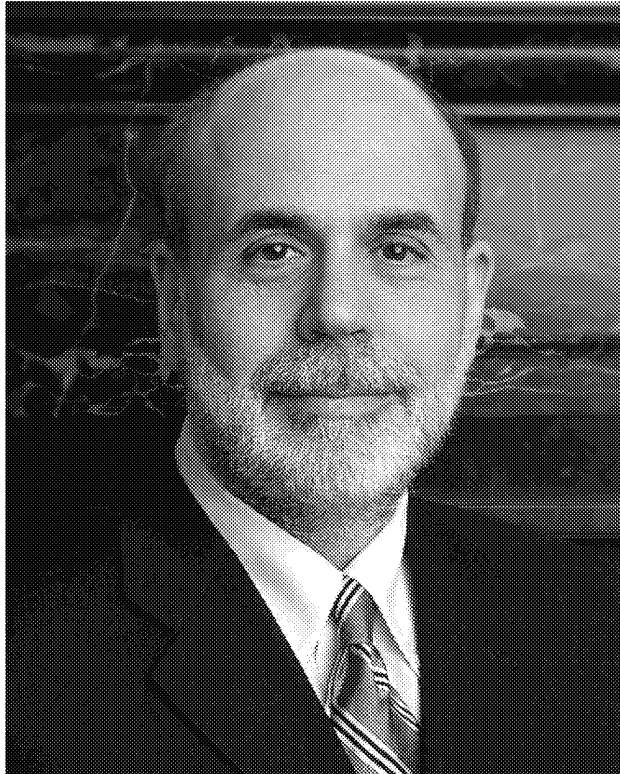# EXHIBIT 37
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Project Bernanke
(Draft as of 11/27/2013)

Background

The gTrade team in content ads optimizes how GDN bids on behalf of Adwords buyers to exchanges outside of AdSense, such as Ad Exchange (AdX), AWBid, etc. The team was created in early 2013 motivated by the observation that ███████████████████████ ██. Some of the challenges bidding on exchanges include i) intense competition from other buying networks, ii) dealing with publishers who can create unconventional auctions with high reserve prices, and iii) risk from paying the publisher for every impression while only charging GDN buyers for clicks.

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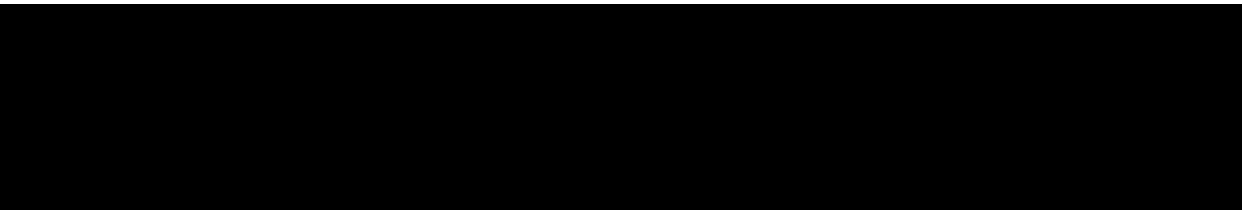███

AdX Bidding before Bernanke

GDN is the only AdX buyer that submits two bids to AdX. The motivating factors are i) to ensure "fair" payout to the publisher, e.g. keep GDN buy-side margin at no more than 14%, and ii) to improve publisher monetization. By submitting two bids, the publisher effectively earns the same
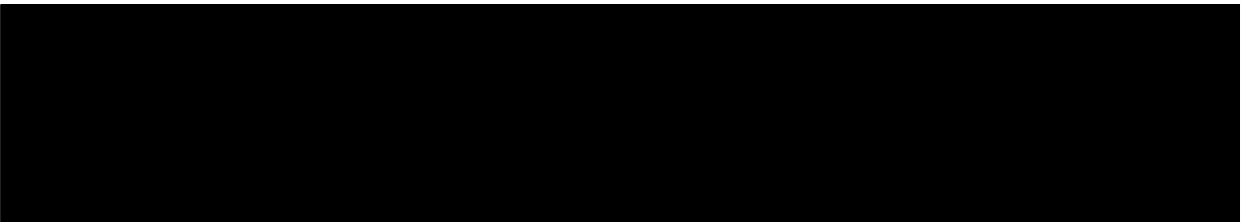
revenue as if the bids were submitted directly to the exchange rather than being first aggregated by the CAT2 auction.

It's important to note that buy-side margin can only be computed over a **reasonably large block of revenue on a group of queries.** GDN usually earns CPC from advertisers on rare click events but pays CPM to the exchange on every query. Therefore, query-level margin is not meaningful. For each publisher, we try to pay the exchange at least $0.86X for every $X in revenue, when looking at revenue over a period e.g. one day.
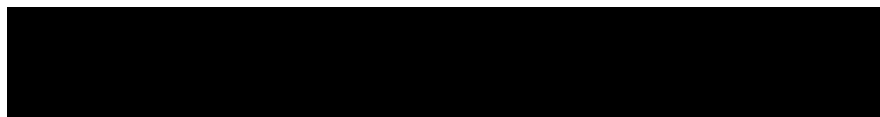
When GDN first started bidding on AdX, we would simply take out the 14% buy-side margin on each query as shown in the table below:

Notice that if another AdX buyer bid between 0.86b1 and b1, GDN will lose the query even though GDN could have won by reducing revshare to less than 14%. To capture this opportunity, GDN launched dynamic revshare in 2012.

In all cases, the advertiser cost may be written as

The implications of this formula are
1. The GDN advertiser always pays at least the CAT2 second price.
2. The GDN advertiser never pays more than the CAT2 first price.
3. GDN tries to keep margin at 14%, but will reduce if a lower margin would win the query.

Because GDN margin is at most 14% on every query (in terms of eCPM), the expected overall rev-share across a group of queries will be at most 14%.

Bidding with Bernanke

The second bid submitted to AdX is a huge monetary subsidy to the publisher. GDN second prices itself on 80% of queries won on AdX, and the second bid almost doubles the revenue that AdX

publishers receive from GDN. Put another way, without second bids GDN margin would be about ██ and AdX publishers would earn about ██████ less revenue! Note here that AdX publishers refer to publishers that get paid per impression and not Adsense publisher that get paid per click that are AdX enabled.

Project Bernanke (launched Q4 2013) tries to spend this subsidy in a smarter way. Bernanke further optimizes the two bids that GDN submits to AdX such that buy-side margin remains 14% per publisher, but the overall GDN revenue, profit, and payout to the publisher is maximized.

Bernanke computes bid modifiers (k1, k2) to apply per query, i.e.

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The modifiers can change from query to query, but always ████████████████

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Overall, we can tune k1 and k2 such that the total margin remains 14% across all queries on the publisher. Since GDN revenue has increased, and buy-side margin remains 14%, the GDN payout to the exchange (and hence publisher) increases. It is possible that some GDN revenue displaces AdX buyer revenue, but from simulations and experiments the overall payout to the publisher almost always increases.

Computing the Bid Multipliers

We need to determine an optimal approach to reduce the second price and increase the first price of the two bids submitted by GDN to the AdX auction in such a way that publishers receive fair payout and GDN profit is maximized. The optimal combination of first bid increase and second bid decrease for each publisher is estimated using AdX auction simulations. In order to gather

data for running the auction simulations, a ████████████████████████████████

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██ It is important
to note that in this entire process, we only use information about the GDN bid and the GDN price paid on queries won by GDN. In other words, we do not use any information from queries won by AdX buyers, since GDN as a bidder should not have access to such data.

For each bid multiplier combination, we compute how much the payout to the exchange deviates from what is construed as fair and add it to a pool. ████████████████████████
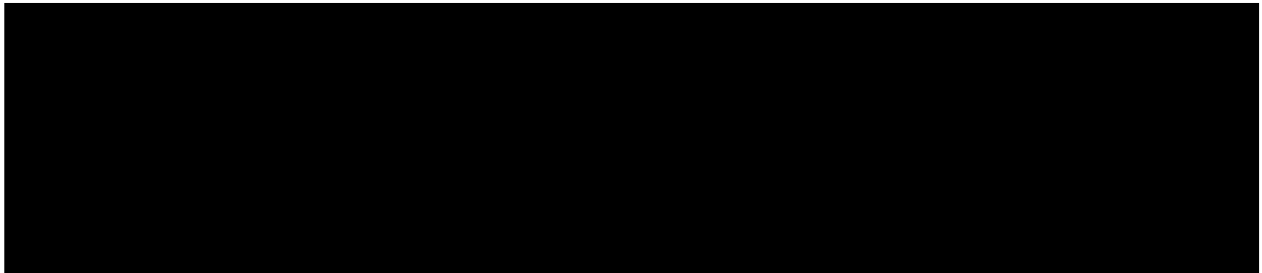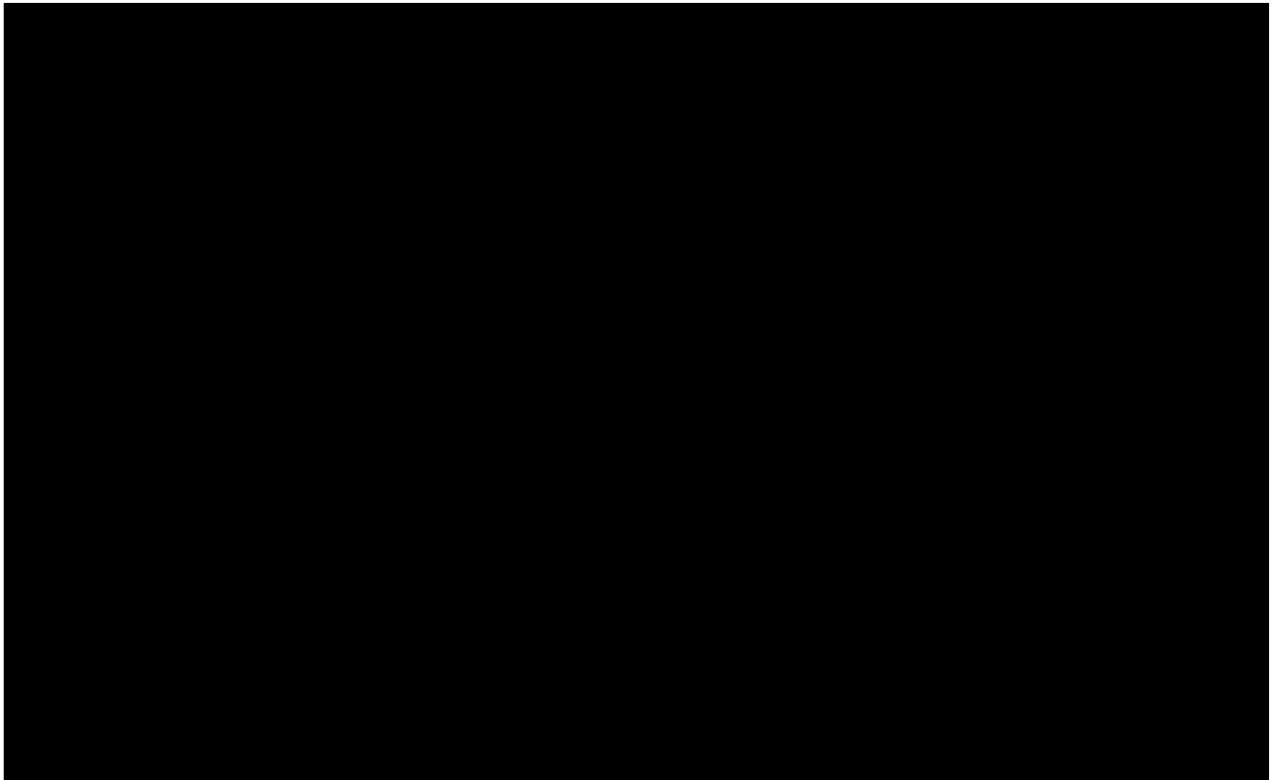
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We run auction simulation every day on the past week of data and push the optimal bid adjustments to production.

Online Margin Monitoring System

Although the auction simulation intends to choose multipliers that ensure fair payout, auction simulations are not perfect for a number of reasons. These include, for instance, day to day variations in traffic, competition, reserve prices, complexities in logging, using past one week of data to predict the future, among others. We have therefore implemented a safety mechanism to ensure fair publisher payout. Since the mechanism to maintain fair margin is to maintain zero pool, in order to ensure that the pool doesn't deviate significantly from 0, an online control mechanism is used where the pool is tracked per supermixer task for each web property. On any query, if this number is larger a pre-determined positive threshold, we do not reduce the second bid on that query. Similarly, on any query, if the deviation is smaller than a pre-determined negative threshold, we do not increase the first bid on that query. This ensures fair payout to each publisher within a reasonable tolerance.
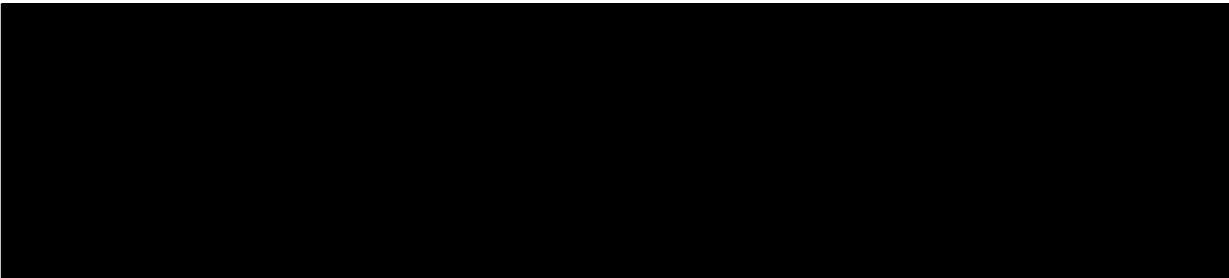
Bernanke Performance

We are currently tuning the system to determine a throttling probability per advertiser, such that Bernanke performs closer to the full potential while avoiding any incentive issues. We are also investigating ways to optimize the bid multipliers at a finer granularity than web property, e.g. using query-level features such as presence of cookie, country, language, mobile vs desktop, etc.

Bernanke Performance Monitoring

We are monitoring the post Bernanke performance of GDN on AdX through several means. A

Team (gTrade)

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- Nirmal Jayaram
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- Woojin Kim (PM)

Other Major Collaborators:

████████

With help and insights from countless others including: GDN auction team, AdX Quality, AdX PM team, AdX engineering.

About the Authors

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Nirmal Jayaram is a quantitative analyst in the content ads team working full-time on gTrade. He works out of the Mountain View office.

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